Use Case – Public Pocket Profile, Automotive

AUTOMATED DRIVING
System Safety

Automotive Use Case

3D MAPPING SOLUTIONS

asc(s Automotive Solution Center for Simulation

SET Labs software enabled technologies

System simulations of Automated Driving functions are systems of **high complexity** – not only from technical, but also from **collaborative** point of view. State-of-the-art processes support credibility in M&S only vague, as they **lack simulation governance and traceability**.

UPSIM will gain credibility in Automated Driving simulations by **introducing reference processes** and **model certification**, as well as applying specific **CI methods for M&S**.

PROGRESS

Application of PRM
Achieved full traceability from product level to Credible Modeling Process of the Static Road Model. Filled the Glue Particle for the Credible Modeling Process.

Credibility Metrics for CDK
Specified specific metrics for Static Road Models. First implementations done.

Extention of Glue Particle
Further development of the STMD-standard conformant implementation as a mapping/connection from artifacts to CI-necessary steps in the CI-pipeline.

Continuous Credibility Assessment
Next to Jenkins, the CI/CD pipeline is integrated into github actions.

OUTLOOK

Credibility Metrics for CDK
Implement further metrics that have been specified.

Extention of Glue Particle
Provide a schema to automize simulation runs with open-source tools (e.g., esmini) in the pipeline.

Continuous Credibility Assessment
Finalize the Continuous Credibility Assessment providing an end-to-end demo.

Use Case – Public Pocket Profile, Automotive

AUTOMATED DRIVING
Driver Monitoring

Automotive Use Case

Infineon

Sensors for complex automotive systems tend to be delivered as so called “intelligent sensors”, that is they execute signal processing on top of signal detection, which may include complex functionality like **neural networks**. When it comes to product release, reliable functionality is key towards trustful usage.

M&S can support the system reliability by simulating effects that can hardly be captured in real-world testing, like concept drift. UPSIM will add a **traceability of simulation input data**, to allow for comprehension of the training process: Which data has been used for training and why?

PROGRESS

Demo Completed
Implementation of simulation pipeline, driver monitoring scenarios and noise generator are completed.

Evaluation
Evaluation of simulation pipeline and monitoring scenarios with / without noise was completed.

Future
Future steps and research directions were defined.

OUTLOOK

CSP
Considering to experiment more with the CSP process

Use Case – Public Pocket Profile, Automotive

UPSIM
UNLEASH POTENTIALS IN SIMULATION

BRAKE SYSTEM

Automotive Use Case

BOSCH

Universität Augsburg University

Brake Systems are representative of highly **integrated systems**, where requirements come from many different domains, posing different requirements towards accuracy, fidelity and computing effort of the simulation. State-of-the-art use cases **require real-time capability** of Brake System SiL models while providing **high accuracy** at the same time.

Credible **Hybrid modelling** approaches, where first-principle-models are enriched with neural networks can help resolving these trade-offs.

PROGRESS

Hybrid model accuracy
A hybrid model showing an accuracy boost of approximately 38% **on validation data** was generated.

Training the neural network
The model was trained on a complete driving maneuver lasting 30s. To deal with the long time series (sampled with 0.1 ms) different strategies for batched training were implemented.

Open-Source activities
Corresponding training methods, simple tutorials, etc. are available publicly in the Open-Source libraries *FMI.jl* and *FMIFlux.jl*

Design Process
A first workflow for designing hybrid models on the foundation of this method was developed. This design process was tested on multiple use cases.

OUTLOOK

Validation in closed-loop environment
The final step is the validation of the hybrid model in the original closed-loop simulation environment. Different workflows for the reintegration of the hybrid model where investigated.

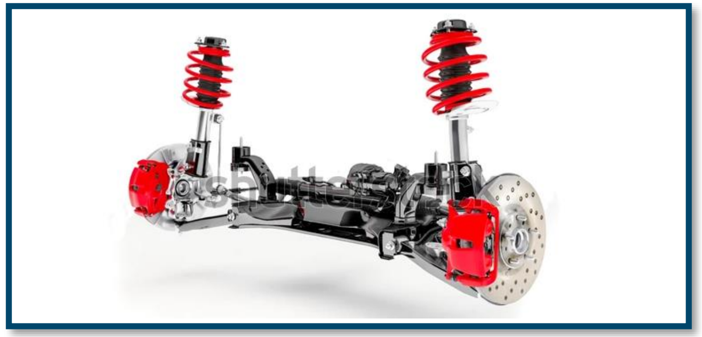
Further improvements
Through further methodological improvements, we are confident that we will be able to improve these results even further by the end of the project.

Use Case – Public Pocket Profile, Automotive

UNLEASH POTENTIALS IN SIMULATION

DRIVING DYNAMICS

Automotive Use Case



DLR

As state-of-the-art algorithms for active suspension systems lack flexibility, Reinforcement Learning agents may pose a valuable alternative for future semi-active suspension systems. However, Reinforcement Learning agents tend to exploit false characteristics of their environment and ingest it into their policy.

UPSIM helps to develop a credible policy by supporting credible simulation environments, supported by **Modelica Credibility** and the **FMI Model exchange standard.**

PROGRESS

Toolchain development
The Modelica Credibility library has been integrated into our Reinforcement Learning Toolchain. Among others, it contains detailed information about uncertainties of model parameters and their origin.

Credible Reinforcement Learning
Definition of a Credibility Reinforcement Learning Process based on the **Modelica Credibility Library** allows parameter sampling during the training to increase the controllers **robustness** against model uncertainties. Automated inheritance of meta-information from the FMU that serves as training environment and logging of training settings make the process **traceable** and **reproduceable**. Finally, in a case of controller failure, a conservative fallback controller is activated to ensure **Fail Safe**.

OUTLOOK

Presentation of the Results
All aspects of the Credible Reinforcement Learning Process are applicable to our driving dynamics use case. How the results are finally presented is open to discussion within WP4.